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Full Length Research paper

Relative abundance of malaria vectors in Ugah, Nasarawa state, Nigeria

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A study on the relative abundance of malaria vectors was investigated in Ugah, Nasarawa state, Nigeria between January and December 2004. A total of 2,276 mosquitoes were collected. The mosquitoes comprise three species - *Anopheles gambiae sl, Anopheles funestus* and *Anopheles ardensis*. Of the anophelines, *Anopheles gambiae sl* is the most abundant that is, 1087(47.76%) followed by *Anopheles funestus* and *Anopheles ardensis* with abundances of 863(37.92%) and 326(14.32%) respectively. Female anophelines were 1,670(73.37%). There was a significant difference in the relative abundance of mosquitoes with respect to season (P < 0.05). A number of factors (awareness, culture, proximity to water bodies) appear to be responsible for the abundance of the mosquitoes. The result suggests that concerted efforts should be made by stakeholders at reducing the abundance of malaria vectors in the rural areas in order to prevent outbreak.

Key words: Relative abundance, mosquitoes, *Anopheles gambiae sl, Anopheles funestus, Anopheles ardensis*.

INTRODUCTION

The burden of malaria varies across different regions of the world and even within a country. In Africa, the burden of malaria remains enormous (WHO, 2006), years after the launching of the World Health Organisation's Roll-Back-Malaria program in the year 1998. About 107 countries and territories involving about 3.2 billion people are still at risk of malaria (WHO, 2005). According to WHO statistics, approximately 40% of the world's population are at risk of malaria, with over 500 million people becoming critically ill with the disease annually (WHO, 2005).

Incidence of malaria is influenced by weather, which affects the ability of the main carrier of malaria parasites, anopheline mosquitoes, to survive or otherwise. Tropical areas including Nigeria have the best combination of adequate rainfall, temperature and humidity allowing for breeding and survival of anopheline mosquitoes. Country-specific evidence shows that Nigeria has the largest population at risk of malaria in Africa and therefore most vulnerable to the risk of missing MDGs target. The disease, malaria, is a major health problem in the country, with stable transmission throughout the country. It accounts for about 50% of out-patient consultation, 15% of hospital admission, and also prime among the top three causes of death in the country (National Malaria Control Plan of Action 1996 to 2001). Approximately 50% of the Nigerian population experience at least one episode per year. However, official estimate suggests as much as four bouts per person per year on the average (WHO, 2002). The trend is rapidly increasing due to the current malaria resistance to first line anti-malarial drugs (WHO, 2000). In Nigeria, malaria is responsible for about 300,000 deaths every year and accounts for 40% public health expenditure (USAID Health, 2005). The cost of malaria treatment and prevention in Nigeria has been estimated to be over $1 billion per annum (Odaibo, 2006). The magnitude of incidence and death due to it is a multiple of all other tropical diseases put together. It is responsible for over 90% of reported cases of tropical disease in Nigeria (Alaba and Alaba, 2003). The above suggests that malaria could be the largest contributor to total disease burden and productivity losses resulting from major tropical diseases in the country. Evidence on Nigeria given by the malaria report 2005 shows that malaria incidence throughout the country had been on the increase over the years ranging between 1.12 million at the beginning of 1990 and 2.25 million by the turn of the millennium 2000 and 2.61 million in 2003.

Studies in various habitats (micro and macro) in Nigeria have demonstrated the abundance of various mosquito

Table 1. Species composition and relative abundance of adult anopheline mosquitoes in Ugah.

Species composition of mosquitoes	Relative abundance	No. (%) of Females
Anopheles gambiae sl	1087	825(75.90)
Anopheles funestus	863	622(72.07)
Anopheles ardensis	326	223(68.40)
Total	2276	1670

species. They include mosquitoes of the genera *Anopheles*, *Culex*, *Aedes* and *Eretmapodites* (Igbinosa, 1989; Iwuala, 1979; Nwoke et al., 1993; Subra, 1981). Various mosquito species from these genera are possible vectors of human diseases, including yellow fever, arboviruses in general, malaria and bancroftian filariasis (Johnson, 1979; Monath, 1979; Service, 1963). Knowledge of the species abundance and disease relationship is of importance in disease forecasting and monitoring. This study is aimed at providing information on the abundance of the adult female anopheles mosquito which will serve as an important tool in vector control.

METHODOLOGY

Ugah (estimated population of about 5,000 people as at 2004) is a village located eastwards of Lafia the state capital of Nassarawa State. It is surrounded by a large body of water which sometimes runover its bank and flood homes nearest to it. It is one of the rural areas in the state. The climate is tropical with annual temperature, relative humidity and rainfall ranges of 24 - 26°C, 72 - 75% and 1400 - 1600 mm respectively. The climate presents two distinct seasons: a rainy season between May and Oct., with high rainfall during the months of Jun. and Aug., and a dry season (Dec. - Feb.) completely devoid of rains. The natural vegetation in Ugah reflects that of the Guinea savanna zone, characterized by a predominance of tall grass, which are frequently removed by violent bush burning activities in the dry season. It was also ensured that the collection methods are replicable in all houses. Mosquitoes were collected indoors using WHO standard techniques and the mosquitoes were collected for a period of 12 months. Captured mosquitoes were preserved in 4% formaldehyde solution (Gillies and Coetzee 1987). This was done in order to preserve delicate parts such as antennae, wings and legs which are of importance in identification. In the laboratory, mosquitoes collected were identified to species and counted under the x50 magnification of a stereo-microscope using pictorial keys for culicines (Hopkins 1952) and anopheline mosquitoes were identified as far as possible using the morphological keys of Gillies and Coetzee (1987). Their sexes were also determined according to Gillies and De Meillon (1968). Mosquito species abundance was depicted in tables and chart and difference in the seasonal relative abundances of mosquitoes were subjected to statistical analysis by student's *t*-test to determine their levels of significance.

RESULT

A total of 2,276 adult mosquitoes were collected. They were represented by three species - *Anopheles gambiae sl*, *Anopheles funestus* and *Anopheles ardensis*. *Anopheles gambiae sl* was the most abundant of the three anopheline mosquitoes that is, 1087 (47.76%) followed by *Anopheles funestus* and *Anopheles ardensis* both having abundances of 863 (37.92%) and 326 (14.32%) respectively. Result shows that female anopheline mosquitoes were more abundant than males. Of the 2,276 anopheline mosquitoes, 1,670 (73.37%) were females while the rest were males. Furthermore, more females than male were recorded in each of the three anopheline species. The species composition and the relative abundance of each species are represented in Table 1. Table 1 shows the relative abundance of adult female anopheline mosquitoes. Figure 1 shows the monthly relative abundance of the adult female anopheline mosquitoes. Result also shows that the anopheline mosquitoes were least abundant during the dry seasons (Jan-March; Nov-Dec) and more abundant during the rains (April-Oct) Figure 1. There was a significant difference in the seasonal relative abundance of anopheline mosquitoes during the study period that is, ($P < 0.05$).

DISCUSSIONS

All species of mosquitoes reported in this study have also been reported by different researchers elsewhere in Nigeria (like those of Adebote et al., 2008 and Okogun et al., 2005). Significantly higher densities of mosquitoes were collected in the rainy than dry season. A study in Kenya opined that the rainy season presents favourable environmental conditions that enhance mosquito breeding and survival, through the proliferation of larval habitats and improved humidity, respectively (Minakaw et al., 2002).

Breeding sources might also have affected the abundance of the mosquitoes. Previous reports (Okogun et al., 2003; Igbinosa, 1989; Okorie, 1978) have shown earthenware material supported breeding of various mosquito species especially *Anopheles* spp in parts of Nigeria. As the study area is a village, earthenware materials remain a favourable breeding habitat for *Ano-pheles* species especially *A. gambiae* and *A. funestus*. The contribution of clay pots and other earthenware materials to malaria endemicity in parts of Nigeria is worthy of note. Clay pots are widely used for storing drinking water specially in cool corners of houses as it is less subjected to environmental temperature changes and keep water cool for longer period where the inhabitant do not have or like the use of refrigerators. The physiochemistry of

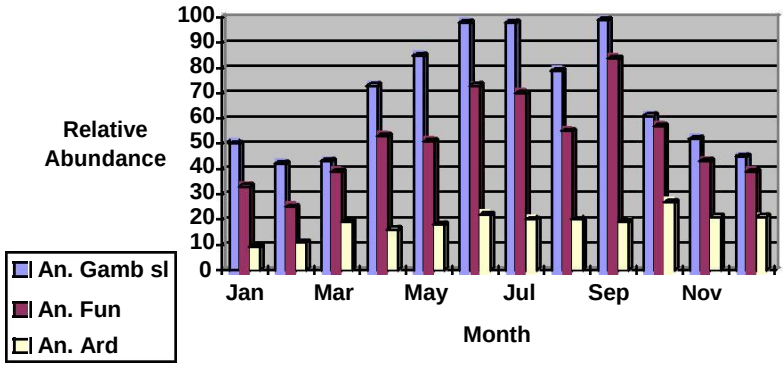

Figure 1. Monthly Relative Abundance of Adult Female Anopheline Mosquitoes in Ugah.

earthenware containers makes them one of the most preferred habitats by *Anopheles* spp in the study area. The indiscriminate disposal of these pots, plastic materials and tins and their domestic uses are contributing factors to the abundance of these mosquitoes. Much of the problem of domestic mosquito breeding and manmade malaria in the study area may also be due to lack of pipe-borne water. Provision of pipe-borne water is a responsebility of government and society which will help reduce mosquitoes breeding around dwelling places. Domestic water storage should be in vessels that will discourage mosquito breeding, e.g. cap-fitted jerry cans.

Poverty and dearth of knowledge or awareness on the dangers or the threats posed mosquitoes to man may also have played its role in the abundance of the mosquitoes. The former, being that 95% of the villagers are peasant farmers who may not be buoyant enough to afford what it takes to effectively combat the vector (in instances where they are informed). The latter is not unconnected with accessibility. Road access to this village is very bad and infact is almost unmotorable during the rainy season. The only sure way of access to the village is by water. This accessibility problem may be highly discouraging for health workers and thus may have been the reason for the lack of awareness and consequently the abundance of mosquitoes.

A. gambiae sl is the most abundant of the three anophelines. This may be a serious health issue as *Anopheles gambiae* is the principal vector of malaria in sub-Saharan Africa in general and Nigeria in particular (Coetzee, 2004; Gillies and Coetzee, 1987). Conversely, *Anopheles ardensis* has the lowest abundance. According to Adebote et al. (2008), *Anopheles ardensis* has not been implicated in malaria or disease transmission generally. It is plausible that this species is zoophilic (Adebote et al. 2008) and may be feeding on domestic animals and other ruminants reared by villagers.

Conclusion

Three species of Anopheline mosquitoes were identified in this study, two (*A. gambiae sl* and *A. funestus*) of which are very important vectors of malaria in Nigeria. This information calls for all stakeholders involved in the concerted effort of malaria vector control to pay particular attention to the rural areas in order to come up with measures that will ensure little risk of exposure to malaria.

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